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Responsive Feeding and Child Undernutrition in Low- and Middle-Income Countries[1,2]

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Abstract

Growth faltering and nutritional deficiencies continue to be highly prevalent in infants and young children (IYC) living in low- and middle-income (LAMI) countries. There is increasing recognition that feeding behaviors and styles, particularly responsive feeding (RF), could influence acceptance of food and dietary intake and thus the growth of IYC. This paper presents the evolution of RF research and the strength of the evidence for RF on child undernutrition in LAMI countries. Multiple approaches were used to identify studies, including keyword searches in many databases, hand searches of retrieved articles, and consultation with experts in the field. Articles were included if they contained a RF exposure and child undernutrition outcome. In total, we identified 21 studies: 15 on child growth, 4 on dietary intake, 3 on disease, and 8 on eating behaviors. Most studies were conducted among children <36 mo of age and were published in the last 10 y. Cross-study comparisons were difficult due to multiple definitions of RF. One-half of the studies were observational with cross-sectional designs and few interventions were designed to isolate the effect of RF on child undernutrition. Overall, few studies have demonstrated a positive association between RF and child undernutrition, although there is promising evidence that positive caregiver verbalizations during feeding increase child acceptance of food. Recommendations for future research include consensus on the definition and measurement of RF, longitudinal studies that begin early in infancy, and randomized controlled trials that isolate the effect of RF on child undernutrition. J. Nutr. 141: 502–507, 2011.

Introduction

Growth faltering and nutritional deficiencies continue to be highly prevalent in infants and young children (IYC)[5] living in low- and middle-income countries (LAMI) (1). Although dietary intake and health are immediate causes affecting nutrition and growth, the UNICEF model (2) shows the importance of child caring practices. There is increasing recognition that feeding behaviors and styles could influence acceptance of food and dietary intake and thus the growth of IYC: the how, why ,and when IYC are fed, as well as what they are fed.

In response to studies in LAMI countries showing caregiver feeding behaviors, particularly active encouragement of eating, were associated with child acceptance of food (3–5), researchers and policy makers began incorporating the concept of responsive feeding (RF) into the scientific literature (6) as well as nutrition programming (7). RF was the result of applying the principle of psychosocial care, drawn from the field of developmental psychology, to the feeding situation (2,6). In the first paper of this supplement, Black and Aboud (8), building on an earlier framework of RF and care, define RF as: "reciprocity between child and caregiver…conceptualized as a three-step process: *1*) the child signals requests through motor actions, facial expressions, or vocalizations; *2*) the caregiver recognizes the signals and responds promptly in a manner that is emotionally supportive, contingent on the signal, and developmentally appropriate; and *3*) the child experiences a predictable response to signals."

Although the formal concept of RF has been in the literature and policy documents for over a decade, its role in reducing child undernutrition in LAMI countries remains uncertain. The purpose of this paper is to present the evolution of RF research, with a review of the methodologies and key findings from descriptive, observational, and intervention studies and to suggest areas of future research related to RF and IYC nutrition.

Search strategy

Broad definitions were used for both RF and child growth. We used keyword searches in multiple databases, hand searches of retrieved articles, and consultation with experts in the field.

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[5] Abbreviations used: CF, complementary feeding; IYC, infants and young children; LAMI, low- and middle-income countries; RCT, randomized controlled trial; RF, responsive feeding; WAZ, weight-for-age Z-score.

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Keyword searches were conducted in PubMed, Web of Science, and CINAHL using combinations of the following terms: responsive, responsiveness, active, feed, feeding, growth, nutrition, and diet. Studies were limited to those published in English, with no limits on year of publication, study country, or child age. Using the UNICEF child undernutrition framework as a guide (**Fig. 1**) (2,7), articles were retained if they had an outcome of child growth, dietary intake, illness, or eating behavior, as well as a measure of RF (6).

Results

The search strategy yielded 895 articles: 834 by database, 53 by expert, and 8 by hand search. Of these, 825 were excluded based on the title, because they were not conducted in humans, did not pertain to children, or were about responsive parenting but not feeding. Of the 70 abstracts reviewed, 49 were excluded because they were not original research (n = 15), were not conducted in LAMI settings (n = 2), or did not meet search criteria (n = 32).

Thus, we identified 21 published studies (**Table 1**) with a RF exposure and child undernutrition outcome: 15 on child growth (4,9–22), 4 on dietary intake (14,18,19,23), 3 on disease (5,14,18), and 8 on eating behaviors (3–5,20,22,24–26). Seven studies reported on more than one type of outcome (4,5,14,18–20,22). Most studies (n = 19) were conducted among children < 36 mo of age (3,4,9–20,22–26) and were conducted in the last 10 y (14–26). Over one-half of the studies utilized direct observation to capture RF behaviors (3–5,9,10,12,15,20,22,24–26), 3 used self-report questionnaires (11,13,17), and 6 were interventions that provided education on RF but did not collect data on RF behaviors (14,16,18,19,21,23). The definition of RF varied widely across studies, ranging from a care index containing 2 behavioral items (i.e. whether anyone helped the child eat and caregiver response to food refusal) to coding schemes used in multi-hour, longitudinal observations that yield a variety of summary measures (e.g. maternal encouragement to eat, type of verbalizations, child acceptance of food). Due to the wide variability in both study outcome and method of RF measurement, it was decided to first illustrate some key publications and methodological advances, presented by type of study design, and follow with a summary of the strength of evidence for RF on outcomes related to child undernutrition.

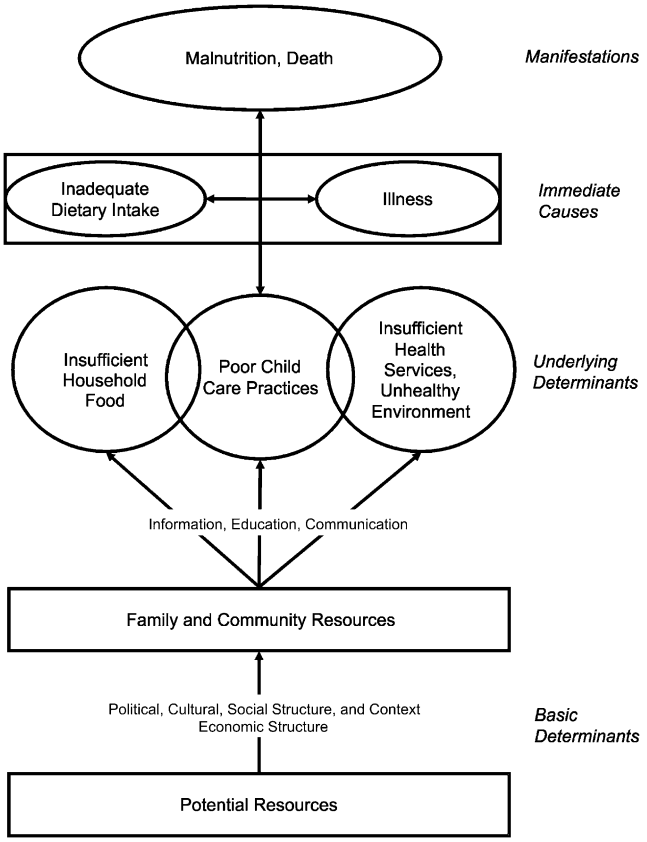

FIGURE 1 The UNICEF child undernutrition framework. Adapted with permission from (2,7).

Evolution of RF research

Ethnographic/mixed methods. One of the first studies to document an association between caregiver feeding practices and child growth was conducted in the 1980s by a nutritional anthropologist, Kathryn Dettwyler (10), who used extensive ethnographic observation in Mali, West Africa. She visited study households ~6 times over the course of 1 y and conducted both open-ended conversational interviews and observations of mealtimes. A key theme that emerged was that many mothers were observed to be laissez-faire, providing the child high autonomy in deciding when and how much to eat: "When a child stops eating, pushes food away, or leaves the area where the food is being served, the mother interprets this…that the child is full. A mother does not encourage, cajole, or bribe the baby to return and eat more food." However, noting variation among the mothers, Dettwyler (10) developed a rudimentary maternal attitude scale and reported that children of attentive mothers had better growth than children of inattentive mothers. This study is noteworthy for its mixed methods and suggestion that caregiver practices are related to child growth.

The 2-country Dietary Management of Diarrhea Program (27) represents an early attempt to systematically code and quantify maternal feeding behaviors. These studies, conducted in Nigeria and Peru in the 1980s, employed mixed methods, including collection of ethnographic, observational, and survey data, to inform an intervention to improve dietary intake during episodes of diarrhea and convalescence (3,11,28–30). The Nigeria study reported on the style of hand-feeding a dilute, fermented maize ('eko') (11,28). Ethnographic data (28) showed that this highly controlling feeding style was normative, occurring as early as 1 mo of age, and that a variation on hand-feeding, force-feeding, was used when children resisted. During force-feeding, the mother occluded the nose with her cupped hand, rendering the child unable to breathe, and forced the child to swallow the food. Data from direct observation in the home showed that both hand- and force-feeding took far less time than feeding by spoon (mean minutes: 2.60 ± 2.1 SD, 2.72 ± 1.3 SD, and 6.05 ± 3.3 SD, respectively) (28), which mothers and grandmothers identified as an important factor, because mothers spent ~8 h/d as market traders and hand-fed to save time. Data from a large survey (n = 1585) also showed that hand-feeding was normative, with three-quarters or more of caregivers in both rural and urban settings practicing hand-feeding when the infant was 0–17 mo (11) and that children whose mothers reported hand-feeding had significantly lower Z-scores for weight-for-age (WAZ), weight-for-height, and height-for-age than infants whose mothers did not report use of hand-feeding (11). Following this study, national policies in Nigeria advocated against hand-feeding.

Observational. Origins of RF emerged from a study in the mid-1990s in Nicaragua that focused on caregivers' verbal encour-

TABLE 1 Characteristics of included studies, presented by type of study

Main author (year)	RF measure	Type[1]	Child outcomes[2] A	D	I	E	*n*	Child age,[3] *mo*	Country
Observational studies									
Case-control									
Alvarez (1982) (9)	Nonverbal language during feeding	DO	X				40	5–11	Chile
Gittelsohn (1998) (5)	Multiple behaviors, including encouragement to eat scale	DO			X	X	156	12–72	Nepal
Cross-sectional									
Bentley (1991) (3)	Maternal encouragement to eat scale	DO				X	40	4–36	Peru
Dearden (2009) (26)	Verbalizations and physical actions of caregiver	DO				X	91	12 or 17	Vietnam
Engle (1996) (4)	Active feeding scale	DO	X			X	80	12–19	Nicaragua
Ha (2002) (24)	Verbalizations and physical actions of caregiver	DO				X	40	12 or 18	Vietnam
Lamontagne (1998) (12)	Multiple behaviors, including active feeding	DO	X				80	12–18	Nicaragua
Moore (2006) (25)	Multiple behaviors, including global definition of RF	DO				X	54	8–24	Bangladesh
Oni (1991) (11)	Use of hand-feeding (yes/no)	SR	X				2655	<36	Malawi
Ruel (1999) (13)	Care index score with 2 RF items: help child to eat (yes/no); how handle food refusals (nothing, other)	SR	X				512	4–36	Nigeria
Longitudinal									
Dettwyler (1986) (10)	Maternal attitude toward health scale	DO	X				136	4–36	Mali
Intervention studies									
Single-group, pre-post									
Sethi (2003) (17)	Single-group pre-post evaluation of active feeding messages delivered with CF messages	SR	X				30	5–19	India
Quasi-experimental									
Cooper (2001) (15)	Quasi-experimental with RF advice delivered alongside advice for managing sleep and crying	DO	X				32	Birth	South Africa
Hotz (2005) (23)	Quasi-experimental with RF message delivered alongside CF mes sages; RF message was ways to encourage children to eat (e.g. actively offer child more if inadequate portion sizes consumed)	NC		X			129	9–23	Malawi
RCT									
Aboud (2008) (20)	RF-only arm; multiple RF messages (e.g. when your child refuses, pause and question why; do not force feed or threaten)	DO	X			X	202	12–24	Bangladesh
Aboud (2009) (22)	RF-only arm; multiple RF messages (e.g. be responsive; watch, listen, and respond in words to your child's signals)	DO	X			X	203	8–20	Bangladesh
Bhandari (2001) (14)	RF message delivered alongside CF messages and food assistance; RF message was encouragement to feed supplement	NC	X	X	X		418	4	India
Bhandari (2004) (18)	RF message delivered alongside CF messages; RF message was ways to encourage children to eat more	NC	X	X	X		1115	Birth	India
Penny (2005) (19)	RF message delivered alongside CF messages; RF message was to teach your child to eat with love, patience, and good humor.	NC	X	X			377	Birth	Peru
Ruel (2008) (21)	Education on child caring and feeding practices from WHO Guiding Principles for Feeding of Breastfed Child delivered alongside CF messages and food assistance	NC	X				1580	12–42	Haiti
Schroeder (2002) (16)	Education on good caretaking practices based on UNICEF Facts for Life delivered alongside CF messages	NC	X				238	5–30	Vietnam

[1] Type of method: DO, direct observation; SR, self-report questionnaire; NC, not collected.
[2] Outcomes: A, anthropometrics; D, dietary intake; I, illness; E, eating behaviors.
[3] For interventions, represents child age at time of recruitment.

agement of eating and offer of additional food, along with the relation between caregiver and child mealtime behaviors, and was termed active feeding (4). To capture behaviors, direct observations were conducted in the home on 2 unanticipated days, 2 wk apart, for 3–5 h/observation. A key finding was that both caregiver and child feeding behaviors varied significantly across meal occasions, thus highlighting the importance of observing more than 1 type of meal.

Two studies in Vietnam utilized videotape in the observation of meals and snacks as part of an evaluation of a community-based nutrition intervention to improve child growth (24,26). While researchers previously used videotaped data to examine variation in infant feeding among urban compared with rural caregivers in central Peru, these are among the first published studies to use the methodology. Both studies utilized in-home observations of a main meal on 2 occasions, separated by 7 or more days. A key finding across studies was that positive verbalizations were associated with greater child acceptance of food. For example, Dearden et al. (26) found that child acceptance of a bite was more likely when the caregiver used positive compared with no verbalization, but less likely when the verbalization was mechanical/direct, such as "open your mouth" or "eat". However, analyses by the type of physical action showed that children were more likely to accept bites

when caregivers used pressuring or forceful behaviors compared with direct ones, such as assisting a child in using utensils (26). Hence, one important contribution of these studies was documentation that specific caregiver feeding behaviors can have meaningful impacts on children's actual acceptance and consumption of food. However, these studies were cross-sectional and our understanding of the long-term effects of these behaviors on children's acceptance remains unknown. A second contribution is the use of videotape, which represents a major advance in the field, as it allowed researchers to capture and code a greater number of behaviors and decreased the likelihood of missing behaviors.

Interventions. Two studies, conducted in India and Peru, were the first to include RF messages as part of a nutrition education intervention delivered through existing local primary health care systems (18,19). In both settings, nonresponsive feeding behaviors were observed during the formative phase of research. In Peru, caregivers were worried about child food refusals and problems of appetite, which were not currently addressed in health facility counseling. In India, IYC were observed to eat very small quantities at each meal. The RF message in Peru was "Teach your child to eat with love, patience, and good humor." In India, the intervention included strategies to encourage children to eat more. Both studies were cluster-randomized field trials in which the RF messages were embedded with complementary feeding (CF) messages in an intervention arm. In Peru, the inclusion of the RF message enhanced interest in the feeding counseling and, in India, more caregivers in the intervention compared with the control group reported active encouragement for children to eat at 9 and 18 mo (34.8 vs. 7.7%, $P < 0.0001$ and 89.7 vs. 49%, $P < 0.0001$, respectively) (19). Although both studies found positive impacts of the intervention on children's dietary intakes and growth, the independent effect of RF could not be determined, because participants received education on both RF and CF.

One of the first published trials to isolate the effect of RF on child diet and growth was a cluster-randomized field trial in 37 villages (19 intervention and 18 control) in rural Bangladesh (22). In both intervention and control villages, mothers of infants 8–20 mo old received education on child development and child health and nutrition, which included advice on CF. Mothers in the intervention villages also received education on RF: *1*) self-feed; let your child pick up food and eat; *2*) be responsive; watch, listen, and respond in words to your child's signals; and *3*) when your child refuses, pause and question why; do not force feed or threaten. Although the intervention significantly increased maternal verbal responsiveness during meals and child self-feeding, there were no differences between groups in either attained weight or WAZ.

Summary of RF and child undernutrition

Child growth. Of the 15 studies on RF and child growth (4,9–22), 6 were observational (4,9–13) and 9 were interventions (14–22). Four of the 6 observational studies documented positive associations of RF with 1 or more child growth outcomes, such as WAZ or height-for-age Z-score (9–11,13). However, RF was measured differently across studies, including the number of positive expressions during feeding (9), a maternal attitude scale for child health (10), an active feeding scale (4,12), the use of hand-feeding (11), and a care index containing 2 behavioral items (13). Of the interventions, 7 were randomized trials (14,16,18–22), 1 was quasi-experimental (15), and 1 had a single-group, pre-post design (17). All but 1 (22) of the interventions showed a positive impact on a child growth outcome. However, most interventions were not designed to isolate the effect of RF; RF messages were embedded within a larger package that included nutrition education and/or food supplementation (14,16,18,19,21) or education on managing children's sleep and crying (15). Of the 2 interventions explicitly designed to manipulate RF, results were mixed (20,22), with 1 study showing significantly greater weight gains and attained weights among intervention compared with control children (20), but the other found no significant differences between groups (22). Thus, the current evidence for RF on child growth is promising, but weak; longitudinal studies and more randomized controlled trials (RCT) isolating RF are needed.

Dietary intake. Only a handful of studies ($n = 4$) have examined the influence of RF on children's dietary/nutrient intake (14,18,19,23). All were interventions: 3 were randomized trials (14,18,19) and 1 was quasi-experimental (23). All reported positive findings that the intervention improved intakes of key nutrients or complementary foods, but none were designed to isolate the effect of RF. More research is needed.

Illness. Three studies have examined the role of RF in child illness (5,14,18). One study utilized a case-control design in which feeding observations were conducted after diagnosis of xerophthalmia (5), which is problematic, because caregiver behaviors measured after diagnosis of illness may not represent those actually occurring prior to or concurrent with development of disease, as was shown by Bentley et al. (3) in the Peruvian Dietary Management of Diarrhea study. The other 2 studies were randomized trials in which RF was not isolated (14,18).

Eating behaviors. Of the 8 studies identified (3–5,20,22,24–26), 6 were observational (3–5,24–26) and 2 were interventions (20,22). Each study documented at least 1 significant association between a caregiver feeding behavior (e.g. maternal encouragement to eat, positive verbalization) and a child eating behavior, most commonly reported as child acceptance of food. However, the nature of the relationship is difficult to characterize due to the variable methods used to define and capture RF. Several studies have shown that positive verbalizations are associated with higher child acceptance of food (24–26), whereas neutral or negative verbalizations are associated with lower acceptance (24,26). The role of physical caregiver behaviors on child acceptance is less clear; nonresponsive physical behaviors, such as the use of physical pressure or force-feeding, have been associated with both greater (26) and lower child acceptance of food (24). In studies that combined verbal and physical actions of the caregiver into 1 measure, findings were also mixed. Two studies found that child acceptance was higher among caregivers displaying positive behaviors (3,25), another found children requested food less when caregivers used positive behaviors and more when they displayed negative ones (5), and, finally, another found that higher levels of any encouragement, the scale did not differentiate between positive or negative behaviors, were associated with lower child demand for food (4). The 2 interventions (20,22) were RCT with a RF-only arm. Neither intervention increased the total number of mouthfuls children ate but did significantly increase the number of mouthfuls children fed themselves, possibly suggesting greater child autonomy in feeding. Findings were mixed for child refusals, with 1 study finding no significant difference between groups at any time point (20) and the other finding significantly fewer refusals among intervention children immediately after the intervention but not at a 5-mo

follow-up (22). Hence, the strength of evidence for RF in child eating behaviors depends on which RF variable is used. There is promising evidence that the type of caregiver verbalization matters, but the evidence for the role of other types of behaviors, including physical actions, levels of maternal encouragement, and child autonomy, is weak.

Discussion

This paper has described the evolution of theoretical and methodological research on RF in LAMI countries. There have been major advances, beginning with carefully conducted descriptive/observational studies using mixed-methods, through several intervention studies focusing on behavior change related to RF skills. Although some studies show similar patterns, such as low levels of caregiver verbalization or physical help to the child during feeding in several settings, the laissez-faire style of feeding, there is diversity in feeding styles within and across settings. In many LAMI settings, where the nutrition transition is well underway (31), it is likely that more pressuring, controlling, or indulgent feeding styles will increasingly emerge that may result in overfeeding (32).

Many of the studies reviewed report on cultural ethnotheories of differential feeding styles, the cultural beliefs that guide how infants and toddlers are fed and that are passed down through inter-generational parenting and communication (6,33,34). Understanding such cultural belief systems and other local factors that influence how children are fed, such as the importance of maternal time for feeding infants described in the Nigerian studies (28), is critical for developing intervention research or programs. Several of the studies consisted of multidisciplinary teams, including anthropologists, nutritionists, and child development experts among others, a strength of the research. However, care must be taken, whether working in a single- or multi-disciplinary team, to gain consensus on the domains of behavior that will be targeted. Including too many domains, particularly in interventions of short duration, may overwhelm participants and fail to produce change.

What should be the direction of future research? First, differential definitions of RF make comparisons across studies and interpretation of results difficult and, the field would do well to reach consensus on indicators that have been tested for reliability and validity. Approximately 10 different methods were used to capture RF behaviors, with the 2 most commonly used methods utilizing direct observation but taking very different approaches to coding. In 1 method, observers coded each action or utterance into broad categories, including self-feeding, RF, active feeding, social behavior, or distraction (20,22,25). In the other coding scheme, observers recorded data at the level of the intended bite; e.g. who fed the child, whether there was eye contact, the caregiver's physical or verbal actions, and the interest of the child (e.g. eagerly accepts food, accepts initially then rejects, completely rejects) (3,24,26). Both methods have demonstrated reliability.

Second, many of the studies have been cross-sectional and conducted among infants 4 mo or older. Cross-sectional designs cannot determine temporality; thus, for even the consistent associations, such as caregiver verbalizations, we do not know whether negative caregiver verbalizations decrease children's acceptance of food or whether children's food refusals lead to negative caregiver verbalizations. Clearly, there is a need for longitudinal research, particularly studies that begin as early in infancy as feasible, because it has been shown that caregivers modify their feeding behaviors based on the developing characteristics of the child, such as the infant's temperament or weight status (35,36). Caregiver and child feeding behaviors at any given point in time are in part the product of feeding interactions occurring prior to that point.

Other important considerations are the inclusion of factors that influence the ability of caregivers to perform optimal feeding behaviors, such as maternal nutrition, depression, household decision-making, and time allocation. Also, the use of videotape or structured observations to actually see how caregivers are feeding their infants is now relatively standard in this research. Although the challenges of data analysis are considerable, these methods move the research forward, because they decrease the likelihood of missing behaviors and allow us to capture many more types of behaviors than previously possible.

Finally, much can be learned from intervention research, such as in the studies in India and Peru (18,19) and the interventions in Bangladesh that isolated the effects of RF on diet and growth (20,22). A large, longitudinal RCT in Andhra Pradesh, India, has just been completed that employed a 3-arm design: a standard of care group, a CF group, and a CF plus RF group (37). Data were not yet available for this review.

In conclusion, RF should be situated in the context of breastfeeding and CF guidelines; they are part of a package (38). The evolution of the research is impressive, but there is much yet to be learned about how to best measure RF and how to weave RF messages and skills into behavior change interventions in diverse settings. This goal will require an in-depth understanding of not only what children are fed, but how, when, and why.

Acknowledgments

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